METHOD FOR ADJUSTING AN AUTOMATIC TRANSMISSION RATIO

The present invention relates to the control of automatic transmissions with discrete or continuously variable ratios. They apply to all types of automatic or automated transmissions with discrete or continuously variable ratios.

When these transmissions have an automatic control mode and a manual control mode, the invention relates only to the automatic mode. The subject of the invention is the management of actions by the driver in automatic mode, and, to this end, it constitutes a method for adjusting the ratios of an automatic transmission, as opposed to the facilities for genuinely exiting from the automatic mode by the driver, when he wants to take full charge of the control of speed shifts, as in a manual transmission.

When a vehicle equipped with an automatic transmission has two transmission control arms on, or near, the steering wheel, the driver can, in theory, use these control arms (instead of a conventional control lever), to control up- or down-shifts in a so-called "pulsed manual control" mode.

According to the usual provision in the art, the driver must initially choose the option to exit from the automatic mode by setting a lever or knob to the appropriate position. He can then control up- and down-shifts by successive presses on the (+) arm and on the (-) arm. In these conditions, if the driver has chosen to exit from the automatic mode for the manual mode, he has taken control of the changes of ratio, until deliberately initiating a return to automatic mode, which he does by returning the lever or knob to the appropriate position.

With this known control principle, if the driver forgets to return to the automatic mode after temporarily wishing to take control of the changes of ratio, he remains, despite himself, in manual mode.

The invention proposes a different mode of operation, according to which the changes of ratio requested by the driver are imposed on the transmission if first conditions are satisfied. A ratio adjusted in this way is maintained until second conditions for returning to automatic mode are satisfied, and the automatic mode is automatically restored when the second conditions are satisfied.

With these measures an adjustment, or up- or down-shift "override", can be directly imposed on the transmission when the requisite conditions are satisfied, without actually exiting from the automatic mode, since the latter is automatically restored when circumstances permit.

Preferably, the adjustments requested by the driver will take priority over complementary functions, such as ratio blocking on lifting the foot, or down-shifting on braking.

According to a particular embodiment of the invention, the action means are arms disposed near to the steering wheel, or on the steering wheel.

The present invention will be better understood from reading the following description of a non-limiting embodiment of the latter, by referring to the appended drawing, in which figure 1 illustrates the method proposed by the invention.

Figure 1 summarizes, in a simplified way, the proposed control method that makes it possible to take into

account and process the actions of the driver in automatic mode to request a higher or lower ratio.

The block 1 determines the type of set of shift laws (for transmissions with discrete ratios) or the type of variogram (for transmissions with continuously variable ratios) according to a certain quantity of information representative of the environment, of the drive train, of the driver, and of his driving actions.

In this block, the selection of a set of shift laws, or of variograms, is made according to the driving style, the gradient of the road, road grip, or even driver requests expressed by means of buttons (snow, sport, etc.), or even according to operating characteristics of the drive train, such as transmission oil temperature.

When a number of sets of shift laws (or variograms in the case of continuously variable ratio transmissions) are associated with the determination of the driving style, the block 1 can, for example, make its choice by applying a method described in publication FR 2 741 931.

Similarly, when a number of sets of shift laws (or variograms in the case of continuously variable ratio transmissions) are associated with the determination of the gradient of the road (upward and downward), the gradient of the road can also be determined and taken into account in the block 1, according to the teaching of publication FR 2 737 761.

In the case where one or more sets of shift laws (or variograms in the case of continuously variable ratio transmissions) are associated with the determination of the road grip, the latter can also be taken into account in the block 1, according to a known method such as that of publication FR 2 772 865.

Finally, as indicated in figure 1, the block 1 can also take into consideration the temperature of the oil, in the case where one or more sets of shift laws (or variograms in the case of continuously variable ratio transmissions) are associated with the protection of the drive train (engine or gearbox), according to the temperature of the engine oil, for example.

In these conditions, a set of shift laws (or variograms in the case of continuously variable ratio transmissions) is selected in the block 1, to best satisfy the wishes of the driver, taking into account the driving situation.

The block 2 corresponds to a module for determining the transmission ratio according to the speed of the vehicle and the engine load (the engine load can, depending on configurations, be the accelerator pedal, a quantity representative of the request by the driver expressed as power or torque, or even the aperture of the engine fuel inlet control device). In this block, conventional operating curves are used to determine the required ratio set-point which should be applied to the transmission.

According to the invention, this ratio set-point can be adjusted to take account of the actions of the driver to request an up-shift "plus action" or a down-shift "minus action".

Finally, the object of the block 3 is to propose an adjustment of the ratio that has been determined by the block 2 by taking into account any actions of the driver, "plus action" (up-shift request) or "minus action" (down-shift request), and other information needed to manage the ratio adjustment effectively. According to the invention, the information taken into account in the block 3 is, in a non-limiting way:

- "plus action" (up-shift request by the driver),
- "minus action" (down-shift request by the driver),
- engine load,
- primary speed,
- engine speed,
- kick down information,
- gearshift lever position information.

According to the invention, when an up-shift request is made by the driver, this request is processed as follows. If the activation conditions below are satisfied:

- plus action = 1, and
- primary speed > threshold (not currently under-speed), and
- lever position = Drive (not currently in Neutral, Park or Reverse), and
- kick down = 0 (driver does not request a kick down), and
- required ratio < maximum ratio allowed by the transmission,

then an up-shift is imposed: adjusted ratio = required ratio + 1.

The conditions for returning to automatic mode following the up-shift that has just been made are then:

- minus action = 1 (down-shift request), or
- primary speed < threshold (currently under-speed), or
- engine speed > threshold (currently over-speed), or
- lever position ≠ Drive (currently in Neutral, Park or Reverse), or
- kick down = 1 (driver requests a kick down), or
- timer timed out (to remain in adjustment mode for a minimum time), or
- required ratio = adjusted ratio (the automatic mode requests the same ratio as the driver).

Similarly, down-shift requests by the driver may be

processed as follows. When the activation conditions below are satisfied:

- minus action = 1, and
- primary speed < threshold (to avoid an over-speed), and
- lever position = Drive (not currently in Neutral, Park or Reverse), and
- kick down = 0 (driver does not request a kick down), and
- required ratio > minimum ratio allowed by the transmission,

then a down-shift is imposed: adjusted ratio = required ratio - 1.

The conditions for returning to automatic mode following the down-shift that has just been made are then:

- plus action = 1 (up-shift request), or
- primary speed < threshold (currently under-speed), or
- engine speed > threshold (currently over-speed), or
- lever position not Drive (currently in Neutral, Park or Reverse), or
- kick down = 1 (driver requests a kick down), or
- timer timed out (to remain in adjustment mode for a minimum time), or
- required ratio = adjusted ratio (the automatic mode requests the same ratio as the driver).

Finally, according to another characteristic of the invention, in the case where the automatic transmission has complementary functions such as "ratio blocking on lifting the foot", "down-shifting on braking", or any other function of this type, then the adjustments made at the request of the driver in the conditions indicated above will preferably take priority over the complementary functions.

There are many advantages of the invention. Compared to the so-called pulsed manual control mode, the

"overriding" of the shifts that is performed in automatic mode provides a way of taking into account the requests of the driver (+ action or - action), while remaining in this automatic mode.

This method provides for a far more comfortable drive than the conventional pulsed manual mode, because the driver can change ratio in automatic mode as required, and when he stops acting on the ratio decisions, then the conventional automatic mode is restored, and the transmission ratio changes are made automatically.